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SPECIFICATION

1. Title of the Invention

BALLOON CATHETER

2. What is claimed is:

(1) A balloon catheter characterized in that double films to be laid over each other are coupled together via a plurality of link sections laid out between said both films at adequate intervals, a bag-shaped body is formed by tightly sealing around said double films, opposing two sides of said bag-shaped body are firmly attached together to form a cylindrical balloon, a catheter having a guide wire lumen, a fluid feeding passage parallel to said lumen and a port through which a fluid from said passage is spouted is put through along one side of said cylindrical balloon in such a way as to provide airtightness in said cylindrical balloon, an outer surface of said catheter is adhered to a near inner face on said one side of said balloon in such a direction that said port is opened into said balloon, and a linear passage space section is provided at an inner surface of said cylindrical balloon along said catheter.

3. Detailed Description of the Invention

[Field of Industrial Application]

The present invention relates to an improvement on a balloon catheter in order to expand the blood vessel constricted by embolus, from inside by being inserted into the embolised blood vessel.

[Prior Art]

There is a well-known balloon catheter that expands a constriction section, which occurs in a blood vessel, with a balloon. In a typical balloon catheter a balloon that expands by injection pressure of a radiation impenetrable fluid, which is fed through the inside of the

catheter, is integrally provided on the outer surface of the catheter, the balloon portion is guided to a constriction section in a blood vessel via the catheter, and the balloon is expanded inside the constriction section to expand the blood vessel.

Another type is known where an elongated balloon is wounded around a catheter and a fluid is fed inside the balloon to eliminate embolus in a blood vessel with a spiral balloon at the outer surface of the catheter (Japanese Patent Laid-Open Publication No. S63-192457).

[Problem to be Solved by the Invention]

Of the conventional balloon catheters, a typical type expands a blood vessel having a constriction section from inside with the inner pressure of the balloon, so that the intention is achieved in the view point of expanding a diseased blood vessel. However, the outer surface of the balloon tightly adheres to the inner face of the blood vessel when the blood vessel is expanded by the expansion of the balloon, thereby completely blocks inside the blood vessel with the balloon. This blocks the flow of a blood, however temporarily, bringing a pain and a danger to a patient.

By way of contrast, with a spiral balloon although the outer surface of the spiral balloon tightly adheres to the inner face of a blood vessel, the spiral shape of the balloon allows a blood to flow along the balloon, so that the spiral balloon has an advantage of being able to prevent the blockage of the blood flow over the balloon catheter that completely blocks the flow of a blood. As the spiral balloon is originally intended to penetrate an embolus portion in a blood vessel and remove the embolus portion as the spiral balloon is pulled out, however, the balloon does not positively urge the flow of a blood, rather merely permits the flow of a blood along the spiral groove, and thus has a drawback that a blood does not flow smoothly.

[Means for Solving the Problem]

The present invention overcomes the problem of the conventional balloon catheter, and aims at providing a balloon catheter with a cylindrical balloon having a linear passage to ensure smooth flow of a blood also inside the balloon at the time of expanding a blood vessel having a constriction section by expanding the balloon.

As specific means for the object, the present invention is a balloon catheter characterized in that double films to be laid over each other are coupled together via a plurality of link sections laid out at adequate intervals between the both films, a bag-shaped body is formed by tightly sealing around the double films, opposing two sides of the bag-shaped body are firmly attached together to form a cylindrical balloon, a catheter having a guide wire lumen, a fluid feeding passage parallel to the lumen and a port through which a fluid from the passage is spouted is put through along one side of the cylindrical balloon in such a way as to provide airtightness in the cylindrical balloon, an outer surface of the catheter is adhered to a near inner face on the one side of the balloon in such a direction that the port is opened into the balloon, and a linear passage space section is provided at an inner surface of the cylindrical balloon along the catheter.

[Function]

This balloon catheter has a cylindrical balloon held at the outer surface of the catheter in a contracted form, and when the catheter is moved inside a blood vessel to the position of a constriction section caused by embolus in the blood vessel by a guide wire inserted in the catheter, a radiation impenetrable fluid is fed under pressure through the fluid passage provided in the catheter from the proximal end of the catheter, and the pressurized feeding of the fluid into the balloon via the port expands the balloon around the catheter in a cylindrical form, thereby

expanding the blood vessel from inside.

Because the balloon is formed cylindrical, its expansion by the inner pressure causes the outer surface to apply an expanding action to the inner wall of the constriction section in the blood vessel and form the linear passage in the inner surface along the catheter at the same time, so that a sufficient blood can be let to flow inside the blood vessel without a resistance via the passage.

The double films that forms the balloon are coupled together by plural link sections laid out at adequate intervals between the films, so that at the time the balloon is moved to a given portion in a blood vessel by the catheter before a work starts, and at the time the balloon is pulled out through the blood vessel after the work is finished, the balloon is moved with the inside and outside films always held integrally via the link sections without losing the laid-over state.

Further, at the time the radiation impenetrable fluid in the balloon is returned into the fluid passage after a blood flow in a blood vessel is done with the expansion of the balloon, the link sections contract the outside film inward with the contraction of the inside film. This can ensure the return of the balloon to the original laid-over state after a work is done, making it possible to carry out the pull-out of the balloon 2 through the blood vessel.

[Examples]

Examples of the balloon catheter according to the present invention will be described referring to the drawings. As shown in Fig. 1, the balloon catheter is composed of a catheter 1 and a cylindrical balloon 2 provided at a part of the catheter 1. The catheter 1 has, at its center portion, a lumen 3 in which a guide wire 4 is to be inserted, and an elongated fluid passage 5 parallel to the guide wire lumen 3. A plurality of fluid

feed/discharge ports 6 are provided in the passage 5 at positions where the balloon 2 is provided.

As shown in Figs. 2 and 3, said balloon 2 is composed of an inside film 7a, a film 7b laid over and adhered to the film 7a in such a way that a predetermined gap 9 is provided via link sections 8 partially laid out at adequate intervals, and an outside film 7c to be integrally laid over and adhered to the top surface of the film 7b by an adhesive. The film 7b and the film 7c are formed of an stretchable film of rubber, latex or the like, and the predetermined gap 9 where a radiation impenetrable fluid 10 flows is formed between the films, as substantially a single film, and the inside film 7a.

The thin films 7a and 7c which are laid over each other via the link sections 8 at the film 7b are formed in a bag shape in such a way that sides 11a, 11b and end sides 12a, 12b are tightly sealed, as shown in Fig. 3.. An insertion section 1a having said ports 6 of catheter 1 is inserted in parallel to said side 11a in the bag-shaped balloon 2 before both end sides 12a, 12b of balloon 2 are welded. Next, as shown in Fig. 2, the outer surface of catheter insertion section 1a, excluding that partial outer surface where ports 6 are formed, is integrally adhered to film 7a by an adhesive in such a way as to be wrapped around by the inner face of single-side film 7a near side 11a. After the catheter insertion section 1a is integrally adhered to the single-side film a of bag-shaped balloon 2, both end sides 12a, 12b of balloon 2 are integrally welded and tightly sealed. At this time, it is necessary to surely make the adhesion in such a way as not to produce gaps between the outer surfaces of both end portions of the catheter insertion section 1a and the adhered portions at both end sides 12a, 12b of balloon 2.

With catheter insertion section 1a wrapped inside bag-shaped balloon 2 as mentioned above, as shown in Fig. 2, the ports 6 in catheter insertion section 1a are open to

the interior of balloon 2, so that in the state, side 11b facing side 11a of balloon 2 is bent and wound in such a way that catheter insertion section 1a is wrapped inside with desired gap 13 left, and both opposing sides 11a, 11b are adhered together integrally along the lengthwise direction of the catheter by an adhesive, thus making balloon 2 in a cylindrical form.

As bag-shaped balloon 2 is held at the outer surface of the catheter in a contracted form with no operating fluid flowing through passage 5 of the catheter, balloon 2 is guided in blood vessel 14 by guide wire 4 to the position of constriction section 15 where embolus is present without interrupting the blood flow. When balloon 2 reaches constriction section 15, radiation impenetrable fluid 10 is fed under pressure through passage 5 from the proximal end portion of the catheter, and is injected into balloon 2 from ports 6 as shown in Fig. 2. As fluid 10 is injected into balloon 2 from ports 6, balloon 2 expands in a cylindrical shape and film 7c side of balloon 2 expands blood vessel 14 at constriction section 15. As space section 16 as a linear passage is formed on film 7a side, the blood flows through space section 16 without being interrupted.

Fig. 4 shows another embodiment, in which case balloon 2 is comprised of two films, inside film 7a and outside film 7c, both of which are integrally laid over each other by arranging link sections 8, formed by a film different from those films, at adequate intervals and adhering them.

[Effect]

According to the balloon catheter of the invention, by providing a cylindrical balloon in which an outside film and an inside film are integrally laid over the outer surface of the catheter by link sections arranged at adequate intervals and the space between both films expands by the pressure of a fluid, expansion of a blood vessel

with a constriction section present by the balloon and the flow of the blood in a passe in the balloon can be achieved without interruption. Further, the double films that form the balloon are coupled together by plural link sections and are always held integrally without losing the over-laid state, thereby ensuring transportation in a blood vessel without problems. Further, when a radiation impenetrable fluid in the balloon is returned into the fluid passage to release the expanded state of the balloon 2, the outside film can be contracted inward by the link sections with the contraction of the inside film. This can ensure the return of the balloon to the original over-laid state after a work is done, and can make the manipulation easier.

4. Brief Description of the Drawings

Fig. 1 is a cross-sectional view showing a balloon catheter according to the invention expanded in a blood vessel, Fig. 2 is an enlarged cross-sectional view along line II-II in Fig. 1, Fig. 3 is a perspective view showing the balloon developed, and Fig. 4 is a cross-sectional view of the same portions as shown in Fig. 2, illustrating another embodiment.

1: catheter,
2: cylindrical balloon
3: guide wire lumen
4: guide wire
5: fluid passage
6: port
7a, 7b, 7c: film
8: link section
9: gap
10: radiation impenetrable fluid
11a, 11b: side
12a, 12b: end side
13: gap
14: blood vessel

15: constriction section
16: space section